

ABSTRACT OF THE DISCLOSURE

A method for depositing metal layers on semiconductor substrates by a thermal chemical vapor deposition (TCVD) process includes introducing a process gas containing a metal carbonyl precursor in a process chamber and depositing a metal layer on a substrate. The TCVD process utilizes a short residence time for the gaseous species in the processing zone above the substrate to form a low-resistivity metal layer. In one embodiment of the invention, the metal carbonyl precursor can be selected from at least one of $\text{W}(\text{CO})_6$, $\text{Ni}(\text{CO})_4$, $\text{Mo}(\text{CO})_6$, $\text{Co}_2(\text{CO})_8$, $\text{Rh}_4(\text{CO})_{12}$, $\text{Re}_2(\text{CO})_{10}$, $\text{Cr}(\text{CO})_6$, and $\text{Ru}_3(\text{CO})_{12}$ precursors. In another embodiment of the invention, a method is provided for depositing low-resistivity W layers at substrate temperatures below about 500°C , by utilizing a residence time less than about 120 msec.